2.3 Working Units

A. Description

1. Pre-Version 8 (V8) MicroStation

   The Caltrans standard drafting software (MicroStation) has 4,294,967,296 Units of Resolution (UOR) in the x-axis and in the y-axis in a pre-version 8 (V8) MicroStation file.

   The UOR is the smallest increment of precision to which the drawing data can be stored in the system (i.e., the drawing resolution). The UOR is defined by the seed file, which can then be changed by the user if desired. This is done by assigning values to working units known as Master Units (MU), Sub Units (SU), and Positional Units (PU). This is accomplished by changing the Resolution (number of Positional Units per Sub Units). The maximum Working Area (or design plane size), which can be included in a drawing, is reduced as the precision is increased (more Positional Units defined for the UOR) because the 4 billion UOR is a constant.

2. Version 8 (V8) MicroStation

   Resolution of the MicroStation V8 design environment sets its size and accuracy. Changing the Resolution changes the size of existing geometry in the model.

   The Resolution setting defines the worst-case accuracy for the design environment, which occurs at the very outer limits of the (very large) working area/volume. For example, working to a “worst case” accuracy of 0.0001 meters, the size of the design plane/cube is 900 million kilometers along each axis. Actual accuracy is many millions of times better when drawing near the origin of the design plane/cube, which is the usual situation *(Defined in Bentley Help document).*

   Designing in CA State Plane Coordinates the elements are only about 1500+/- miles from the center of a 170 million mile English design plane.

   Limit of the MicroStation V8 design plane:
   9,007,199,254,740,991 / 10000 = 900,719,925,474 unitless

B. Units of Resolution for Highway Construction

1. Pre-Version 8 (V8) MicroStation

There is only ONE setting for each pre-V8 MicroStation file for any CADD prepared Highway Construction project (also includes Highway Planting projects), and it shall be:

Unit Names: Master Units (MU)---------- Feet (FT)
Sub Units (SU)---------- Tenths (TN)

Resolution: 10,000 per Foot, as defined by the Sub Units and Positional Units:

Sub Units (SU) ---------- 10 (Tenths per Foot)
Positional Units (PU) ----- 1000 (Pos. Units per sub unit)

Working Area ----------429,496 (feet square)
Approximately 81 miles square

This is the only setting for Highway projects and it should never be changed. If the number of positional units was inadvertently increased (more positional units per tenths), the Working Area (design plane size) would become smaller and the coordinate value of a given precise point would become a different value. The accuracy of measuring and dimensioning would improve, but that is not how Highway projects are handled at Caltrans.

2. Version 8 (V8) MicroStation

For a pre-V8 or V8 MicroStation file it shall be:

Unit Names: Master Units (MU)--------- Feet (FT)
Sub Units (SU)---------- Tenths (TN)

Resolution: ---------- 10,000 per Foot
Working Area (each axis): ---------- 170,591,236 Miles

C. Units of Resolution for Structures

1. Pre-Version 8 (V8) MicroStation

   For a pre-V8 MicroStation file at the Structures base scale 1” = 1’-0” it shall be:

   Unit Names: Master Units (MU)---------- Feet (‘)
   Sub Units (SU)---------- Inches (“)

   Resolution: Sub Units (SU) ---------- 12 (inches per foot)
   Positional Units (PU) ----- 8000 (Pos. Units per sub unit)

   Working Area ----------44,739 (feet square)

2. Version 8 (V8) MicroStation

   For a pre-V8 or V8 MicroStation file at the Structures base scale 1” = 1’-0” it shall be:

   Resolution: ---------- 96,000 per Foot
   Working Area (each axis): ---------- 17,769,920 Miles